REMARKS

This is in response to the Office Action dated December 22, 2006. In view of the foregoing amendments and following representations, reconsideration is respectfully requested.

Initially, by the above amendment, claims 1-4 have been cancelled and replaced with new claims 5-8. The new claims have been drafted to overcome the rejection of the original claims under 35 U.S.C. 112, second paragraph. Note that each of the dependent claims further limits the recited structure. Furthermore, it is submitted that one of the ordinary skill in the art would understand what is being claimed by reciting a "pipe separator." See, for example the publication referenced in the description of the related art.

Next, the specification and abstract have been reviewed and revised, and a substitute specification and abstract has been prepared. No new matter has been added. Also enclosed is a "marked-up" copy of the original specification and abstract to show the changes that have been incorporated into the substitute specification and abstract. The enclosed copy is entitled "*Version with Markings to Show Changes Made*."

On page 3 of the Office Action, claims 1-4 are rejected under 35 U.S.C. § 102(b) as being anticipated by Marker et al. (USPN 1,559,115), Hall (USPN 4,938,878), Komistek (USPN 5,837,152) or EP Patent No. 1044711. It is submitted that the present invention, as embodied by new claims 5-9, now clearly patentably distinguishes over the applied art references for the following reasons.

In the rejection of claims 1-4, the Examiner takes the position that each of the applied references discloses "an oil/water/gas separator having a container with outlets for each fluid and an inlet pipe at approximately the interface, as claimed."

The present invention is directed to a conventional separator including a cylindrical vessel 1 having an inlet 2 and at least three outlets 3-5. The primary novel feature of the present invention is the provision of a pipe separator located upstream of the conventional separator. The pipe separator constitutes a continuation of a supply pipe 7 and extends partly into the cylindrical vessel 1. Thus, the present invention is a combination of a conventional separator and a pipe separator, which provides faster and more effective separation of the fluid to be separated. This is because the liquid to be separated assumes a stratified flow prior to entering the conventional gravitational container. The size of the gravitational container of the conventional separator can therefore be made much smaller (see page 1, lines 21-30 and page 3, lines 17-27 of the present specification).

None of the applied references disclose or even suggest the arrangement defined in new independent claim 5. In particular, **Marker** discloses a complicated separator incorporating a number of horizontal and vertical pipes connected into a system where gas is collected in the upper pipes of the system and oil is collected in the lower pipes of the system. The Marker arrangement is clearly not based on a conventional gravitational separator and lacks a pipe separator disposed upstream of the gravitational separator. Thus, in the Marker device the flow into the system will not be stratified flow.

Hall is directed to an apparatus for the removal of small amounts of water from diesel or oil used in transmissions of, for example, car engines. The arrangement disclosed in Hall includes an upper receiver 17 connected to the upper end of an intermediate section 12, and a lower container 26 having an inlet 27 communicating with the intermediate section 12. The lower container 26 includes an outlet 29. The fluid to be separated in the Hall device is supplied via a conduit 5 which is connected to the separating device 4 via a conduit 6. Clearly, the Hall separator is completely different from the claimed arrangement which requires the combination of a conventional separator and a pipe separator. The Hall device clearly lacks any structure that could be considered a pipe separator, and thus cannot anticipate claim 5 under 35 U.S.C. § 102(b).

Komistek is directed to a conventional separator having a vessel 10 provided with a stratifier pipe 36 connected to an inlet pipe 37 for feeding an emulsion of oil and water to the separator vessel. The stratifier pipe is provided with upper and lower perforations 38. The perforations are sized and distributed so as to allow the oil to fall from the upper perforations and the water to fall from the lower perforations. The purpose of the stratifier pipe is to improve separation. However, the perforations will actually enhance mixing of the oil and water by forcing the two liquids therethrough. Note that the present invention requires a pipe separator connected to the container. Accordingly, it is submitted that Komistek lacks any disclosure of a pipe separator in combination with a conventional separator as required in claim 5.

EP '711 is similar to the Marker system since it includes a large number of horizontal and vertical pipes connected in a system for separating a mixture of fluids into

three phases (i.e. gas, a lighter liquid, and a heavier liquid). This solution is quite different from the present invention because it does not include a conventional separator and does not have a pipe separator connected to the required separator.

In view of the above, it is clear that the present invention, as defined in independent claim 5, is not disclosed or suggested by the applied prior art references.

In view of the above, it is submitted that the present application is now clearly in condition for allowance. The Examiner therefore is requested to pass this case to issue.

In the event that the Examiner has any comments or suggestions of a nature necessary to place this case in condition for allowance, then the Examiner is requested to contact Applicant's undersigned attorney by telephone to promptly resolve any remaining matters.

Respectfully submitted,

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Version with Markings to Show Changes Made

~~Device for separating multi-phase fluids.~~

DEVICE FOR SEPARATING MULTI-PHASE FLUIDS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention concerns a device in connection with a separator for separation of a multiphase fluid, comprising a preferably cylindrical container with an inlet, a first outlet for liquid with a higher gravity (for example water), a second outlet for liquid with a lower gravity (for example oil) and a third outlet for gas.

2. Description of the Related Art

The prior art contains gravitation separators of the above type for separation of fluids such as oil, water and gas which are used in a number of contexts in process plants on platforms and production ships or on the sea bed. However, depending on their capacity, such separators are large and heavy and require a lot of space.

The prior art also contains a new type of separator, called a pipe separator, that has been developed by the applicant of the present application and is based on separation in a pipe by means of laminar flow of the separable fluid in the pipe. This type of separator is very effective, requires little space and can be used at great depths of the sea. EP 0977621 shows and describes ~~such a~~ this type of separator.

SUMMARY OF THE INVENTION

The present invention represents a separator solution based on a combination of the above two separator principles in which additional, more effective separation of the fluid to be separated is achieved.

The present invention is ~~characterised~~ characterized in that a pipe separator is connected to the inlet of the container. The pipe separator constitutes a continuation of the supply pipe for the fluid to be separated and is connected to or extends partially into the

~~container, as stated in the attached Claim 1.~~ container.

By first partially separating the incoming fluid flow in the pipe separator before the further separation in the container, the separation process is ~~optimised~~ optimized, thus achieving better performance and a reduced necessary separator volume.
~~Claims 2-3 define the advantageous features of the present invention.~~

BRIEF DESCRIPTION OF THE DRAWING FIGURE

The present invention will be described in further detail in the following by means of examples and with reference to the attached figure, which shows an elementary diagram of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

As the figure shows, the present invention comprises a conventional gravitation separator 1, comprising a preferably cylindrical container with an inlet 2, a first outlet 3 for liquid with a higher gravity (for example water), a second outlet 4 for liquid with a lower gravity (for example oil) and a third outlet 5 for gas.

At the end of the container 1, a partition 8 is arranged expediently. It extends towards the upper end of the container and forms a threshold for liquid with a lower gravity (oil) to flow over to a chamber 9 on the right side of the container 1, where the second outlet 4 is arranged.

The special feature of the solution in accordance with the present invention is that a pipe separator 6 is connected to the inlet 2 for the conventional gravitation separator 1. The pipe separator 6 constitutes a continuation of a supply pipe 7 for the fluid to be separated and extends partially into the gravitation separator 1. The pipe separator 6 has a diameter that is greater than the diameter of the supply pipe 7 and is large enough for stratified flow to be achieved. The pipe separator is mainly arranged horizontally, which is also a condition for stratified flow. The requirement for horizontality depends on the flow speed, i.e. the faster the flow, the greater the requirement for horizontality. Moreover, the requirement for horizontality for the pipe separator will depend on

whether the flow is two-phase or three phase. Three-phase flow will have a greater requirement for horizontality for the pipe separator 6.

The solution shown in figure is a separator for oil, water and possibly gas, i.e. a three-phrase separator, with water-continuous inflow. With water-continuous inflow, it is advantageous for the inlet 2 to be arranged so that the outlet from the pipe separator 6 extends into the conventional ~~radiator~~ separator 1 at a level that requires the fluid to arrive in the separator in the water layer (water phase) in the separator. Conversely, it is expedient for the inlet to be arranged so that the inflow enters the oil phase in the separator 1 with oil-continuous inflow.

The two liquid phases (oil/water) that flow into the pipe separator 6 will gradually be separated as they flow through the pipe separator 6 so that oil/water layers will gradually be formed with average drop sizes that, at the inlet to the conventional separator 1, are considerably larger than if no pipe separator had been used. This results in the further separation in the conventional ~~pipe~~ separator being considerably faster and the conventional separator can be made much smaller.

The gas will be separated out much faster than the oil/water separation as the gravity of the gas is much lower than that of the two liquids. This means that the gas/gas bubbles, when they reach the container 1, will rapidly rise to the surface of the liquid and thus constitute a gas phase on the top of the surface of the liquid in the container and will be transported away from there via the gas outlet 5.

If a high gas/liquid ratio is expected, a pulse damping inlet arrangement should preferably be arranged in the conventional separator, for example an open screw housing inlet as described in the applicant's own EP patent application no. 1069957. In such case, the inlet 2 should also be positioned at a level higher than the liquid phase in the separator.

The inlet of the pipe separator may expediently be fitted with a device (not shown) to damp the input pulse of the inflowing multiphase flow.

The transition between the pipe separator 6 and the conventional separator 1 should be designed so as to generate minimum shear forces in the flow. This is achieved by using smooth pipes with minimum bending radius (preferably none at all).

The inlet of the pipe separator may expediently be fitted with a device (not shown) to damp the input pulse of the inflowing multiphase flow.

The present invention as it is defined in the claims of the present application is not limited to the example shown in the attached figure and described above. The present invention may, therefore, be used to separate fluids other than oil, gas and water.

~~Abstract~~ ABSTRACT

A device in connection with a separator for separation of a multiphase fluid, ~~comprising~~ including a preferably cylindrical container (1) with an inlet (2), a first outlet (3) for liquid with a higher gravity (for example water), a second outlet (4) for liquid with a lower gravity (for example oil) and a third outlet (5) for gas. A pipe separator (6) is connected to the inlet (2) of the container (1). The pipe separator (6) constitutes a continuation of a supply pipe (7) for supplying the fluid to be separated and extends partially into the container (1).

~~A pipe separator (6) is connected to the inlet (2) of the container (1). The pipe separator (6) constitutes a continuation of the supply pipe (7) for the fluid to be separated and extends partially into the container (1).~~